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(54) Title: ELECTROLUMINESCENT INTERACTIVE PACKAGING DISPLAY WITH SOUND

CROSS SECTION VIEW OF SCREEN PRINTED LAYERS

(57) Abstract

Disclosed is an interactive electroluminescent display container with a transparent or translucent window through which contents of the container can be viewed. A sequencing electroluminescent lamp comprising electrode and phosphor layers is disposed on a portion of the window. The electroluminescent lamp is activated by a touch switch. In one embodiment the electroluminescent lamp is printed on the inner side of the window such that the transparent front electrode of the electroluminescent lamp comprises at least a portion of the window. In this embodiment the touch switch is silver conductive ink printed on the outer side of the window. Also disclosed is a method of producing the electroluminescent interactive display. The method comprises printing a touch switch on a portion of one side of a transparent or translucent substrate, printing an electroluminescent lamp on a portion of the opposite side of the transparent or translucent substrate from the touch switch, incorporating the transparent or translucent substrate into a container such that contents of the container can be viewed through a portion of the transparent or translucent substrate.

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ELECTROLUMINESCENT INTERACTIVE PACKAGING DISPLAY WITH SOUND

BACKGROUND OF THE INVENTION

The invention relates to packaging with a transparent viewing window which includes electroluminescent lighting and sound along with a touch switch to control the lighting and sound.

If typical electroluminescent construction were used for a packaging display it would require either application of an overlay or added artwork to provide color. In the case of packaging displays using clear windows for viewing a product, this presents significant challenges. In order to add electroluminescent lighting to such a packaging display the electroluminescent lamp would either need to be die-cut to fit within the graphic design of the additional color overlay or the product would have to be viewed through two layers of plastic: one being the transparent upper electrode of the electroluminescent lamp portion, the other being the polyester window of the graphic portion.

SUMMARY

The present invention is directed to an electroluminescent assembly used in packaging. It comprises a sequencing electroluminescent display accompanied by sound and activated by touch which is incorporated into packaging displays to provide additional interest in the product contained in the packaging.

Incorporating color within the electroluminescent lamp in the packaging eliminates the need for a secondary graphic overlay, thus allowing the use of electroluminescence without requiring an additional substrate which would result in diminished visibility of the product. The incorporation of color also removes the need for die cutting of the electroluminescent lamp. This process provides an additional benefit in that it allows the surface to maintain it's glossy finish rather than having it obscured by prints.

The display's control centers around a microprocessor based control unit. Two separate power sources isolate the touch switch from the high-voltage present in the electroluminescent lamp inverter switching circuit.

The interactive packaging display utilizes a unique printing process, incorporating colored inks, both within the display, as well as on its surface (to allow touch activation).

DESCRIPTION OF DRAWINGS

Figure 1 shows a cross-section of view of screen-printed layers.

Figure 2 shows the electronics that operate the integrated electroluminescent lamp, touch switch and sound.

Figure 3 illustrates a touch switch printed in conductive ink.

Figure 4 shows a first color layer in an embodiment of the invention

Figure 5 shows a second layer of colored ink in an embodiment of the invention

Figure 6 shows a third layer of colored ink in an embodiment of the invention

Figure 7 shows an opaque backing layer in an embodiment of the invention

Figure 8 shows the phosphor layer in an embodiment of the invention

Figure 9 shows a white dielectric layer in an embodiment of the invention

Figure 10 shows the rear electrode in an embodiment of the invention

Figure 11 shows a uv dielectric layer in an embodiment of the invention

Figure 12 shows the circuitry incorporated in an embodiment of the invention

DESCRIPTION OF THE INVENTION

An assembly for an embodiment of the invention is described in the following paragraphs and illustrated in the appended figures. The electroluminescent assembly broadly comprises packaging which incorporates a translucent or transparent window and an electroluminescent lamp assembly which includes an interactive touch switch.

A transparent or translucent substrate is associated with the packaging. This substrate would most advantageously be composed of a clear polymer although glass could be used alternately. The transparent or translucent substrate can be incorporated into the packaging as one section of the packaging to create a window through the packaging allowing a viewer to see inside the packaging. Alternately the entire packaging could be composed of the transparent or translucent substrate.

An electroluminescent lamp assembly is printed onto the transparent or translucent substrate. The electroluminescent lamp comprises multiple layers.

In one embodiment of the invention the layers include the transparent or translucent substrate of the packaging as the base of the lamp. The transparent or translucent substrate has a top side and a bottom side. The substrate could be composed of a transparent polyester or other suitable material. A touch switch is printed on the top side. The touch switch is generally composed of a colored silver. The graphical and color layers are printed either above or below the substrate. There can be an opaque backing for the parts which will not be lit by the electroluminescent lamp. Layers of different colors are printed above the opaque backing. The electroluminescent lamp assembly is printed on the lower side of the substrate. Typically, a conductive transparent electrode is printed on the lower side of the substrate, a phosphor layer is printed on the transparent electrode. A dielectric layer is printed below the phosphor layer and a rear electrode is printed below the dielectric layer. The circuitry for the electroluminescent lamp is printed below the rear electrode.

Exemplary materials which make up these layers are as follows. Those skilled in the art will appreciate that other materials may be substituted. The rear electrode is made of a silver ink or other conductive material such as Dupont #5025. The dielectric layer is made of a dielectric material such as DuPont product #71500003 (a mixture of diethylene glycol monethyl ether acetate, barium titanate, and titanium dioxide, and other materials). The phosphor layer is made of an electroluminescent phosphor such as Osram Sylvania Electroluminescent Phosphor Type 30 (product #729170) or other electroluminescent materials. The front electrode is made of a printable ITO conductor available from DuPont (product #7160) or Acheson (product #SS-24823) or another preferably transparent or translucent conductive material.

In an alternate embodiment of the present invention a sheet of precoated Indium Tim Oxide (ITO) acts as the transparent substrate. In this embodiment the electroluminescent lamp assembly is printed below the substrate. The ITO substrate acts as the transparent front electrode. Phosphor is printed below the electrode. A dielectric layer is printed below the phosphor layer. A rear electrode is printed below the dielectric layer. Circuitry is printed below the rear electrode. Once again a touch switch is printed above the substrate. A sheet of ITO has a tint to it so in order to allow for transparency of the substrate the ITO layer can be etched away from the transparent substrate in all areas except where the electroluminescent lamp assembly is printed.

The touch switch can be incorporated into the graphics of the packaging and is generally composed of a colored silver. Touching the touch switch results in the electroluminescent lamp or lamps being illuminated in a sequence, attracting attention to the product enclosed in the packaging.

One or more independently addressable electroluminescent lamps or one or more independently addressable picture elements can be utilized in the packaging. If more than one electroluminescent lamp or electroluminescent picture element is used the sequence of illuminating the lamp can be more complicated.

The illumination of the one or more electroluminescent lamps is directed by an electroluminescent controller. This controller can be microprocessor based control unit, a digital circuit or other suitable controlling means. The sequence of illumination is predetermined and differs according to the graphics and packaging. While the controller can be incorporated into the packaging, other options are available. For example, the controller could be incorporated into the shelving used for storing the packaging. Conductors or coils on the shelf and corresponding printed conductors or coils on the packaging could connect the packaging with the controller by induction. This method of controlling or powering the display is described in U.S. Application No. 60/151,046, which is commonly owned by the assignee of this application and is incorporated herein by reference. As a result costs for the packaging would be less prohibitive.

Sound circuitry can be connected to the electroluminescent lamp assembly. The sound circuitry is attached to a sound maker which provides music or another appropriate noise. The unit operates as follows. The lighting and sound associated with the unit are normally off until the integrated touch switch incorporated into the packaging is touched. This touch triggers the touch switch detection circuit. When the touch-switch detection circuit is triggered, it sends a signal through the opto-isolation circuit to the microprocessor based control unit or other electroluminescent controller. Once the signal is received by the microprocessor or other controller, a sequence is sent from the controller to the electroluminescent inverter switching circuit. The sequence sent by the controller switches the electroluminescent inverter's output to corresponding cells on the integrated electroluminescent display. As a result the one or more electroluminescent cells light in a

particular sequence, determined by the controller. One or more sequences can be available.

When a signal is sent to the electroluminescent inverter switching units a signal is also sent to the music circuitry. The signal to the music circuitry initiates the associated sound for the duration of the sequence.

In an embodiment of the present invention the touch switch and the one or more electroluminescent lamps are powered by two independent power sources. As a result, touch switch is electrically isolated from the high-voltage which is present in the electroluminescent lamp inverter switching circuit. The power could be supplied by a battery or through an electric plug, by induction or by another power source, dependent upon the type of packaging display. Battery power can be included in the display itself, making the display self contained. In powering the display by induction as described in U.S. Application No. 60/151,046, the electroluminescent lamp and touch switch obtain electrical power from a secondary, self-contained wire or other coil. The self-contained coil is energized through mutual induction with a physically separated primary coil. The secondary coil behaves like the secondary windings of a transformer. The primary coil may be mounted into or onto the shelving for the container. When the electroluminescent lamp (with integral secondary coil) is placed in close proximity to the primary coil, which is supplied with an alternating current (AC) or pulsed direct current (DC), electrical energy is produced in the secondary coil. This energy flows between the electrodes in the electroluminescent lamp, inducing the electroluminescent material to luminesce.

The detailed description of the invention and the associated figures are intended to be illustrative only and do not define or limit the scope of the invention. The scope of the invention is defined by the appended claims and equivalents thereto.

What is claimed is:

1. An interactive electroluminescent display comprising:

a container having at least one transparent or translucent window through which contents of the container can be viewed;

an electroluminescent lamp comprising electrode and phosphor layers disposed on a portion of said window;

first circuit means for activating said lamp upon contact of an object to a surface of said container;

second circuit means for receiving and carrying power from a power source to said lamp.

2. The interactive electroluminescent display described in claim 1, wherein the first circuit means comprises a touch switch printed on said container.

3. The interactive electroluminescent display described in claim 2, wherein the touch switch comprises printed silver.

4. The interactive electroluminescent display described in claim 1, wherein the second circuit means comprises printed circuitry and means for providing power to the printed circuitry.

5. The interactive electroluminescent display described in claim 4, wherein the means for providing power comprises a battery.

6. The interactive electroluminescent display described in claim 4, wherein the means for providing power comprises hard wiring.

7. The interactive electroluminescent display described in claim 4, wherein the means for providing power comprises induction.

8. The interactive electroluminescent display described in claim 1, wherein at least one electrode layer comprises an indium tin oxide layer and wherein said indium tin oxide layer comprises at least part of said window.

9. The interactive electroluminescent display described in claim 1, further comprising means for producing sound, the means for producing sound being activated by the first circuit means.

10. The interactive electroluminescent display described in claim 1, wherein the display further comprises an electroluminescent controller and wherein the lamp comprises a plurality of independently addressable cells, the electroluminescent controller causing the independently adressable cells lamp to illuminate in a sequence.

11. The interactive electroluminescent display described in claim 10, wherein the controller is a microprocessor.

12. An electroluminescent interactive display comprising:

a container having at least one transparent or translucent window, the window having an inner side and an outer side;

an electroluminescent lamp comprising

i) circuitry;

ii) a rear electrode;

iii) a phosphor layer; and,

iv) a transparent or translucent front electrode,

the electroluminescent lamp being printed on the inner side of the transparent or translucent window with the transparent or translucent front electrode printed closest to the inner side of the transparent or translucent window and the circuitry printed fartest from the transparent or translucent window;

a touch switch, the touch switch being printed on the outer side of the transparent or translucent substrate and being adapted to activate the electroluminescent lamp; and,

one or more means for providing power;

the electroluminescent lamp and touch switch being printed such that the contents of the container can be viewed through at least a portion of the window.

13. The electroluminescent interactive display described in claim 12, further comprising means for producing sound, the means for producing sound being activated by the touch switch.

14. The electroluminescent interactive display described in claim 12, wherein the display further comprises an electroluminescent controller and wherein the lamp comprises a plurality of independently addressable cells, the electroluminescent controller causing the independently adressable cells lamp to illuminate in a sequence.

15. The interactive electroluminescent display described in claim 14, wherein the controller is a microprocessor.

16. The electroluminescent packaging display of claim 14 wherein the touch switch and the electroluminescent lamp are connected to independent power sources.

17. An electroluminescent interactive display comprising:

a container having at least one transparent or translucent window, the window having an inner side and an outer side;

an electroluminescent lamp, comprising

i) circuitry;

ii) a rear electrode;

iii) a phosphor layer; and,

iv) an indium tin oxide front electrode, the indium tin oxide front electrode comprising at least a portion of the window;

the electroluminescent lamp being printed on the inner side of the window;

a touch switch, the touch switch being printed on the outer side of the window and being adapted to activate the electroluminescent lamp; and,

one or more means for providing power;

the electroluminescent lamp and touch switch being printed such that the contents of the container can be viewed through at least a portion of the window;

the indium tin oxide being etched away in the portion of the window where the contents of the container can be viewed.

18. A method of producing an electroluminescent interactive display comprising:

printing a touch switch on a portion of one side of a transparent or translucent substrate;

printing an electroluminescent lamp on a portion of the opposite side of the transparent or translucent substrate from the touch switch;

incorporating the transparent or translucent substrate into a container such that contents of the container can be viewed through a portion of the transparent or translucent substrate.

19. A method of producing an electroluminescent interactive display comprising:

printing a touch switch on a portion of one side of a sheet of precoated indium tin oxide and printing a phosphor layer, rear electrode and circuitry on a portion of the opposite side of the sheet of precoated indium tin oxide, leaving a portion of the sheet of precoated indium tin oxide without printing on it;

etching the indium tin oxide away from the portion of the sheet of precoated indium tin oxide without printing on it.

Fig 1

CROSS SECTION VIEW OF SCREEN PRINTED LAYERS

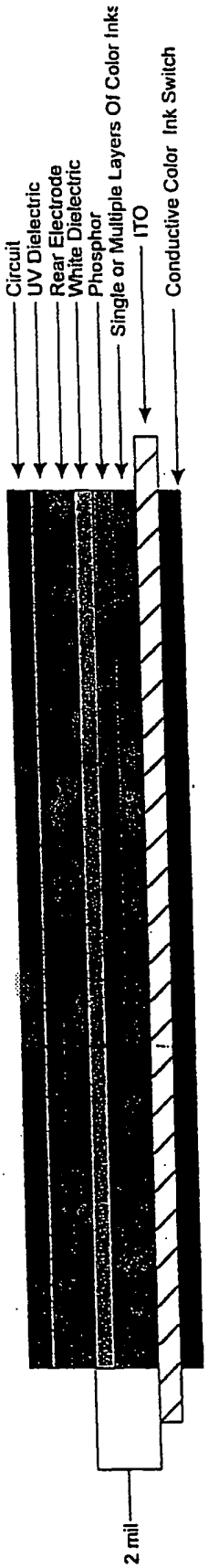
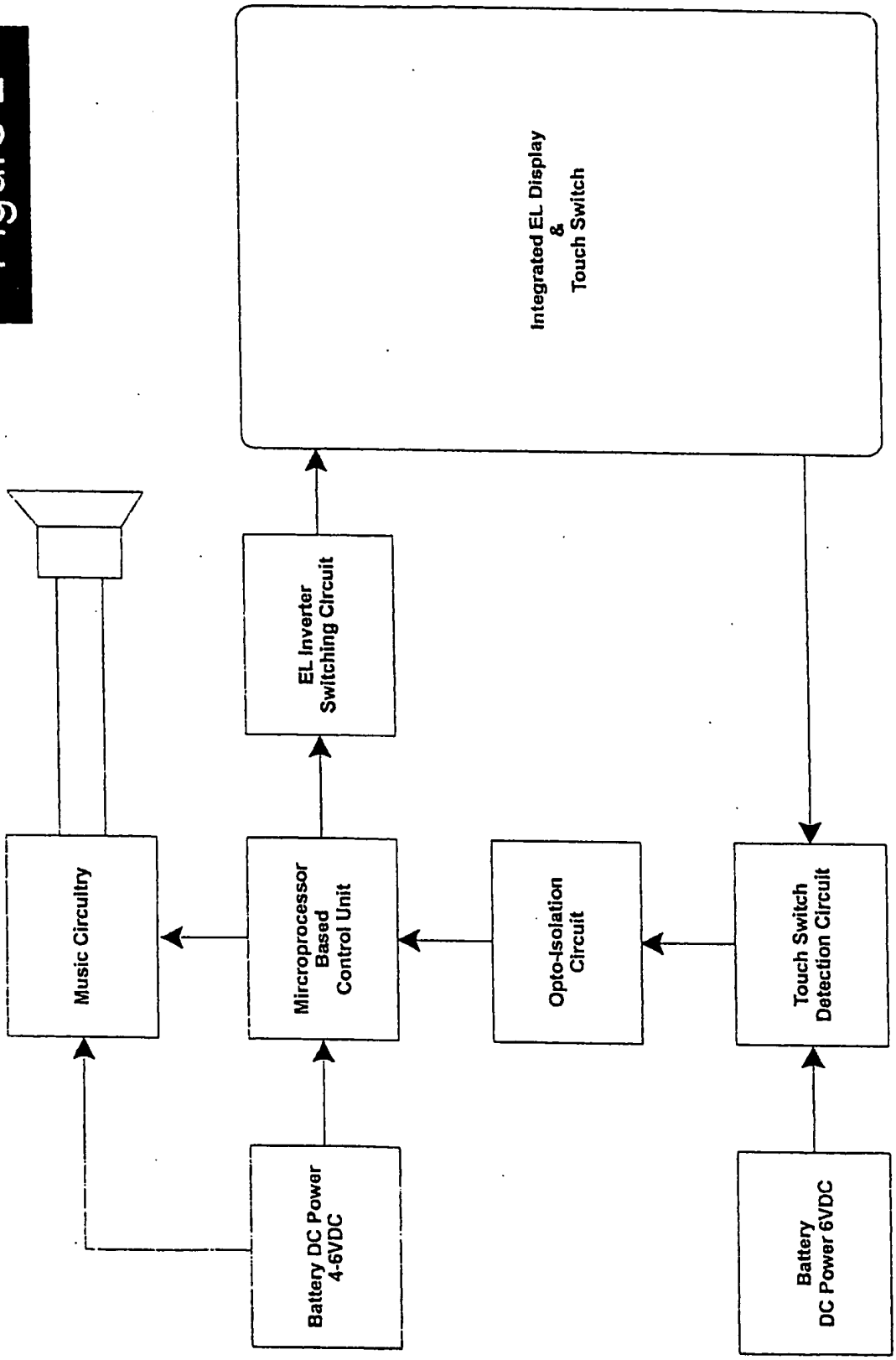
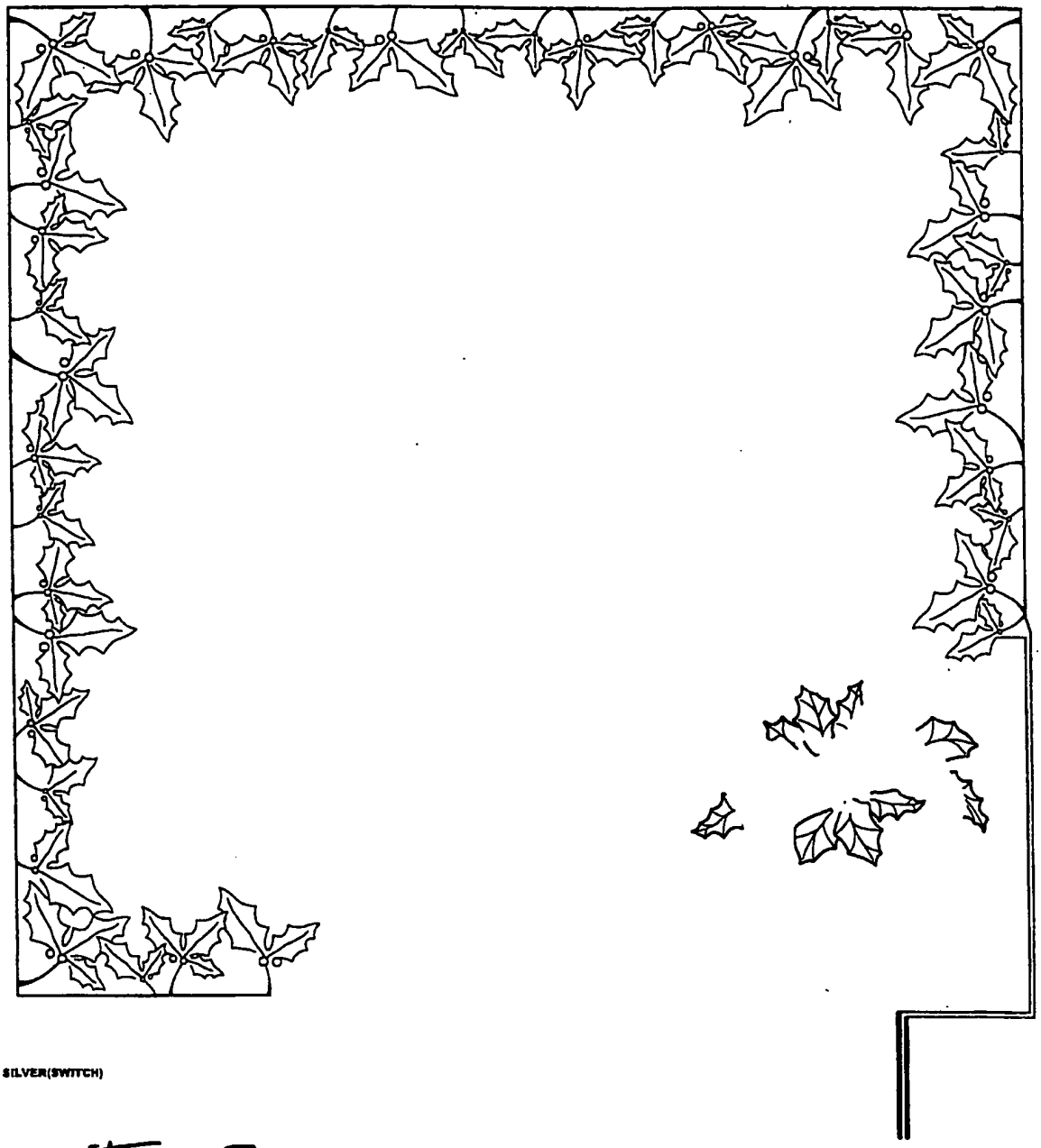


Figure 2


Integrated EL Display
&
Touch Switch
EL Inverter
Switching Circuit
Music Circuitry
Mircroprocessor
Based
Control Unit
Opto-Isolation
Circuit
Touch Switch
Detection Circuit
Battery DC Power
4-6VDC
Battery
DC Power 6VDC



GREEN SILVER(SWITCH)

FIG. 3

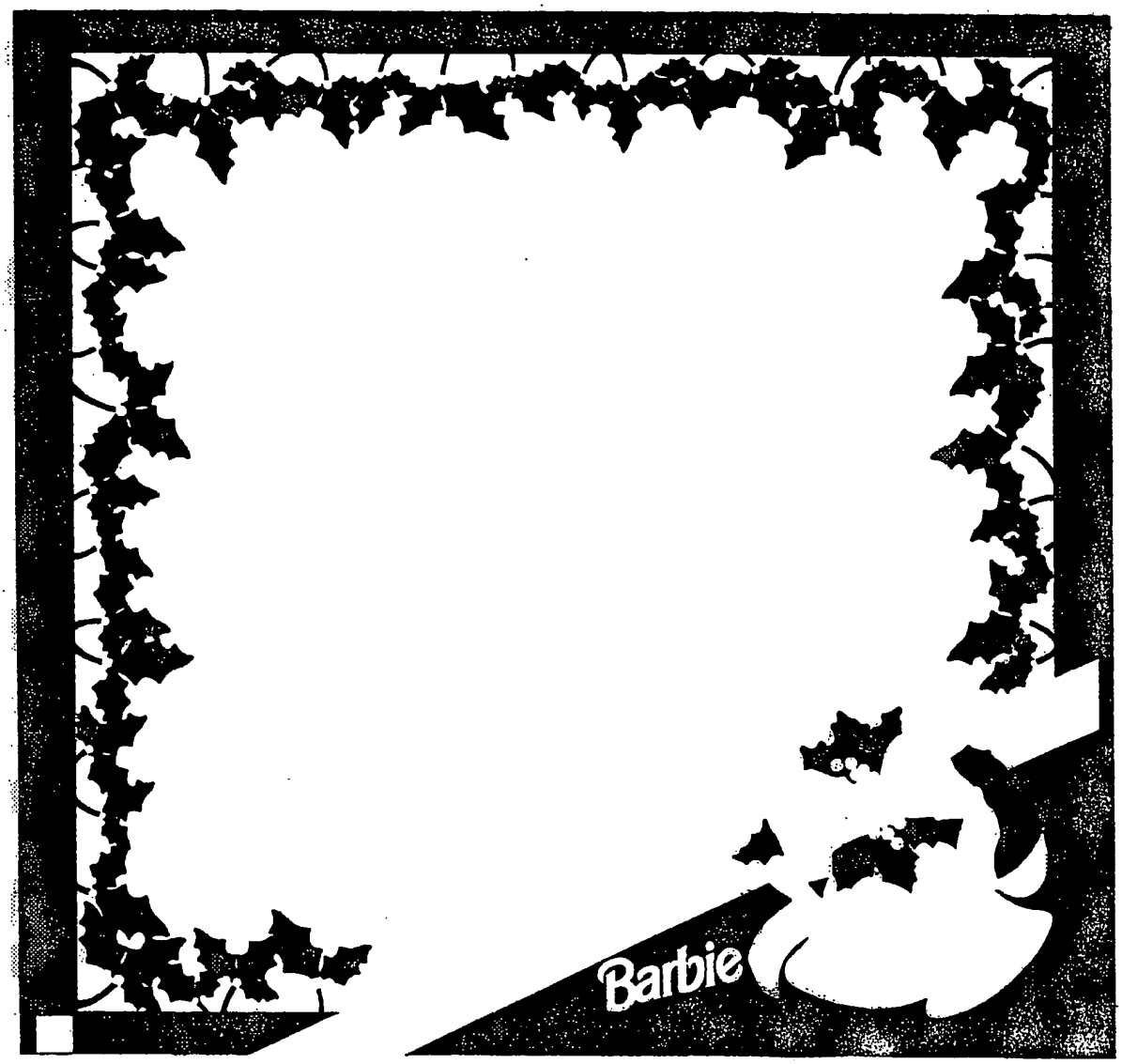


FIG. 4

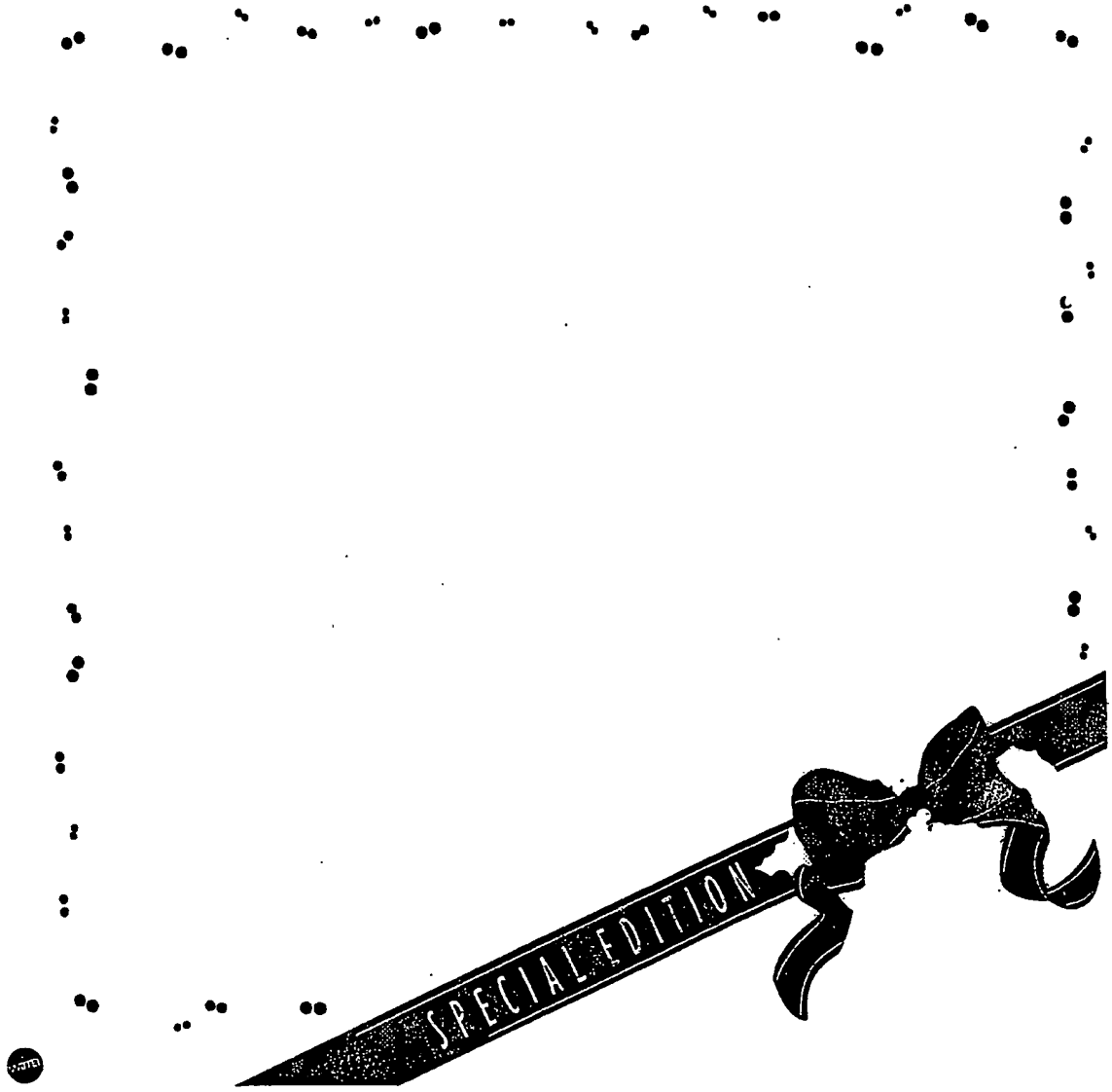


FIG 5

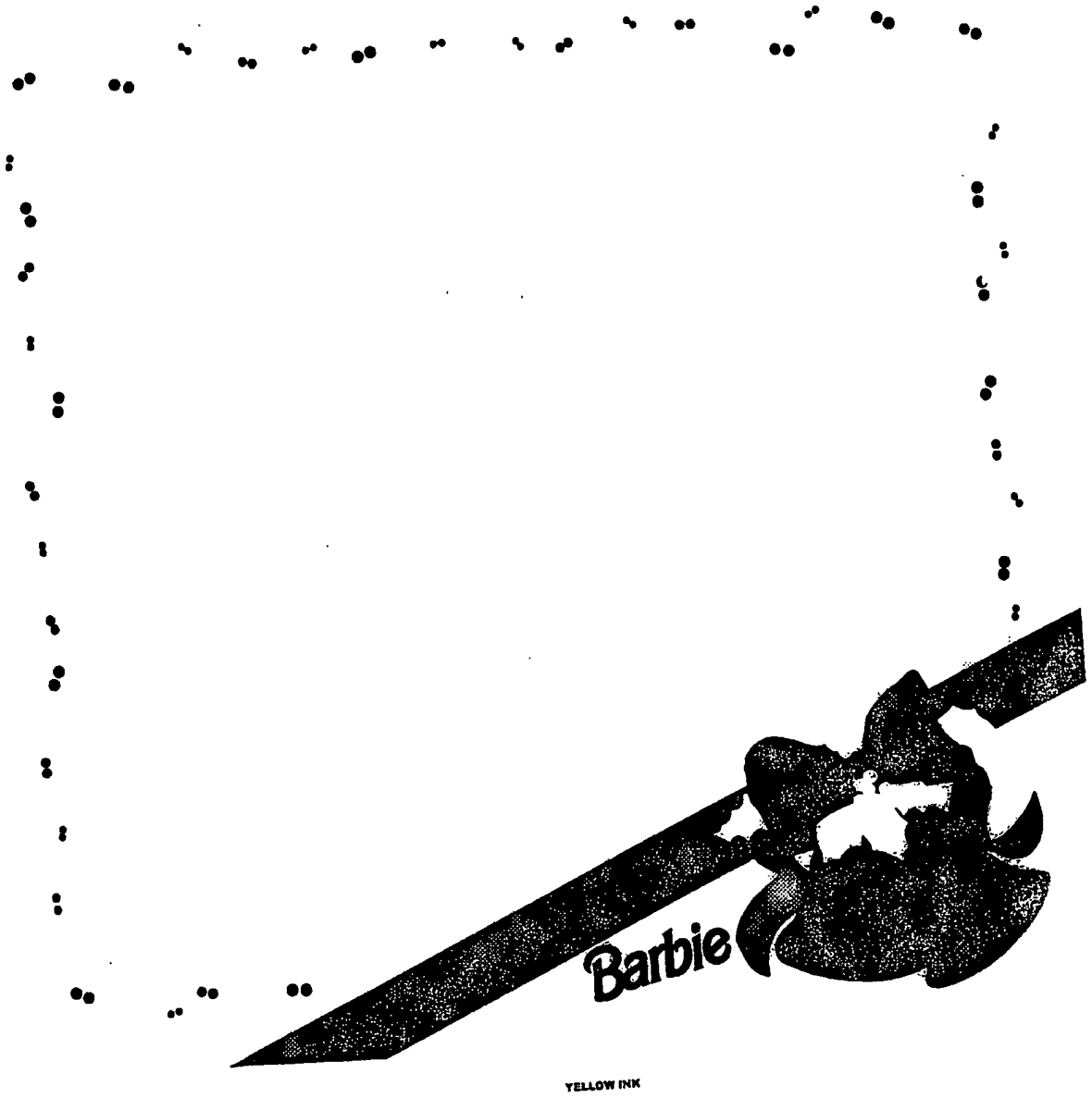


FIG 6

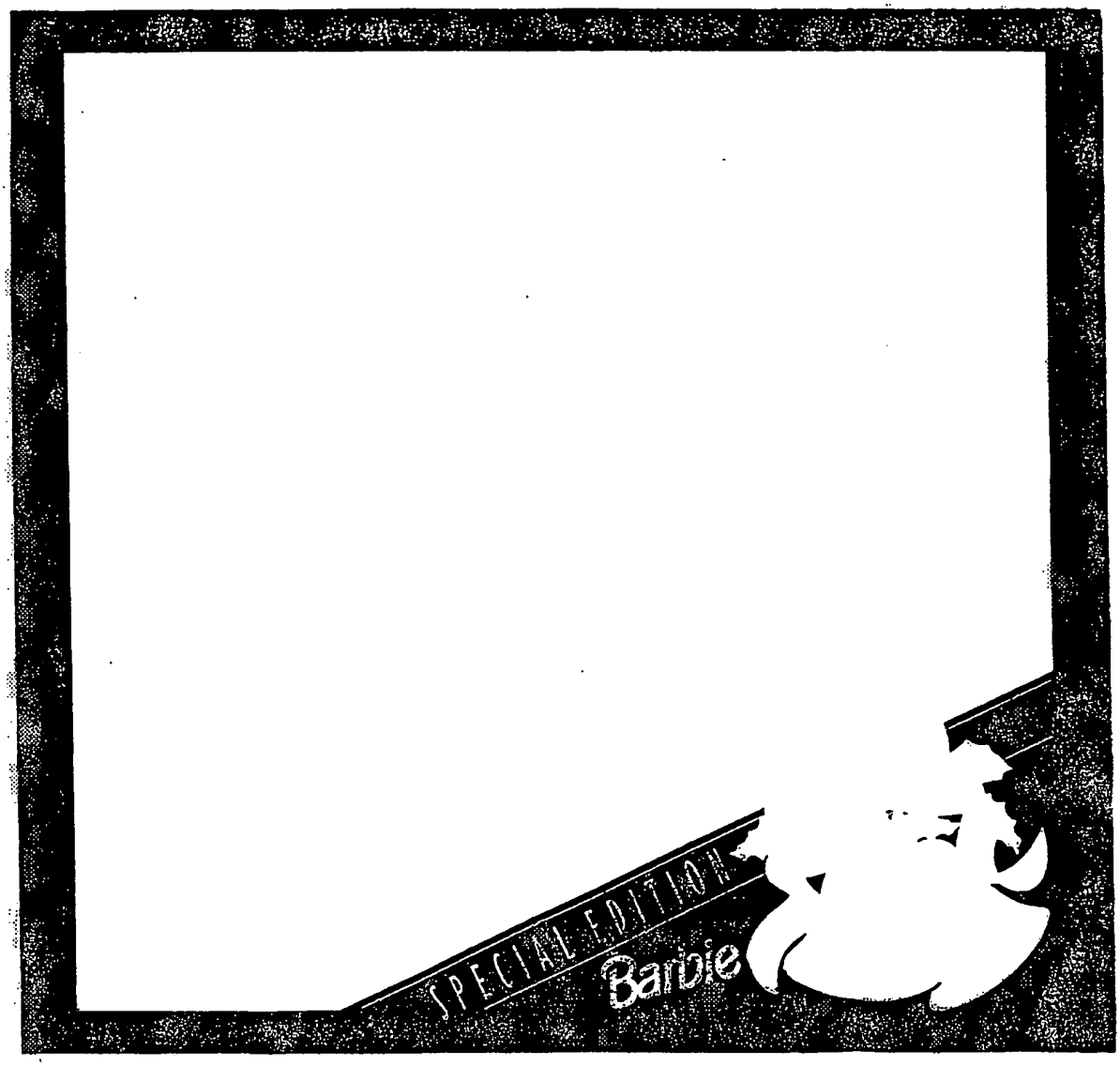
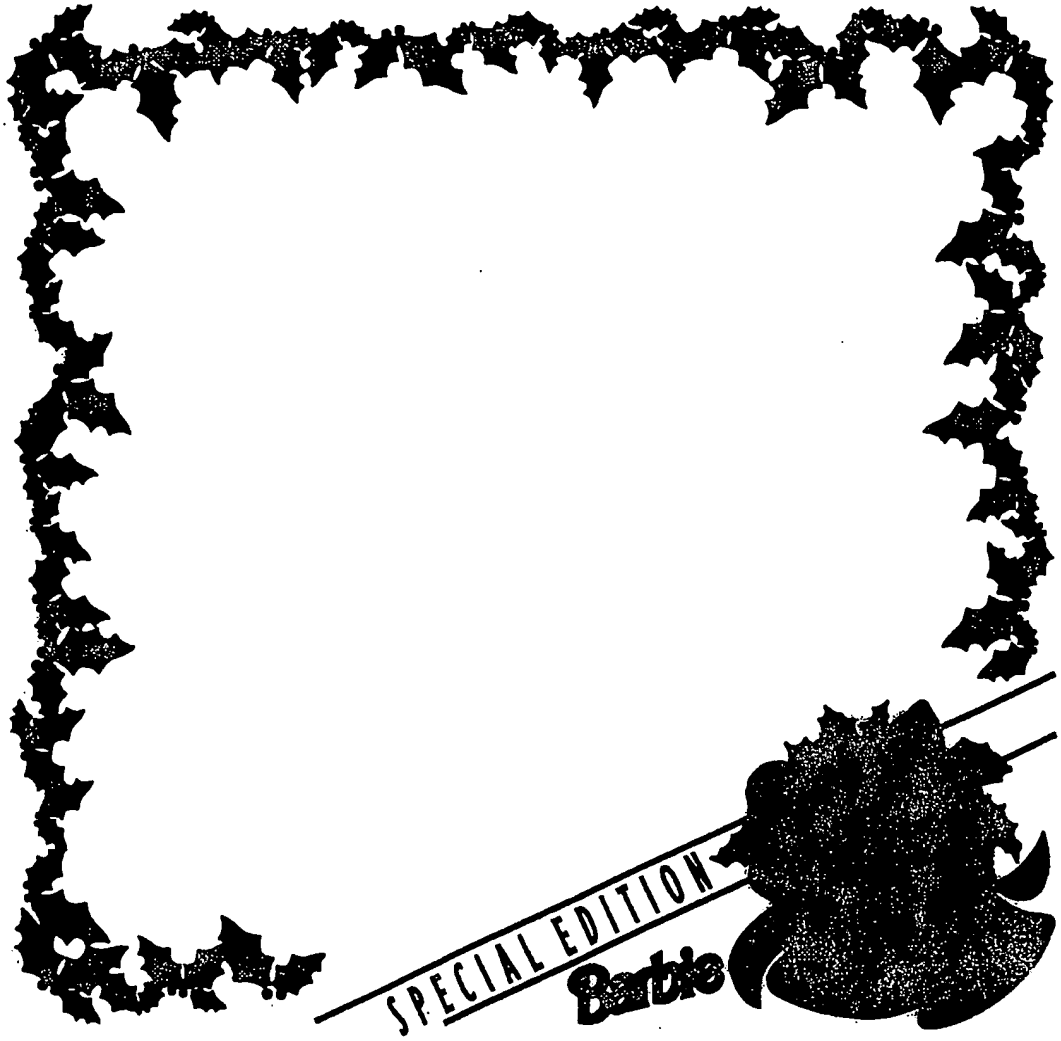


FIG. 7



PHOSPHOR

FIG. 8

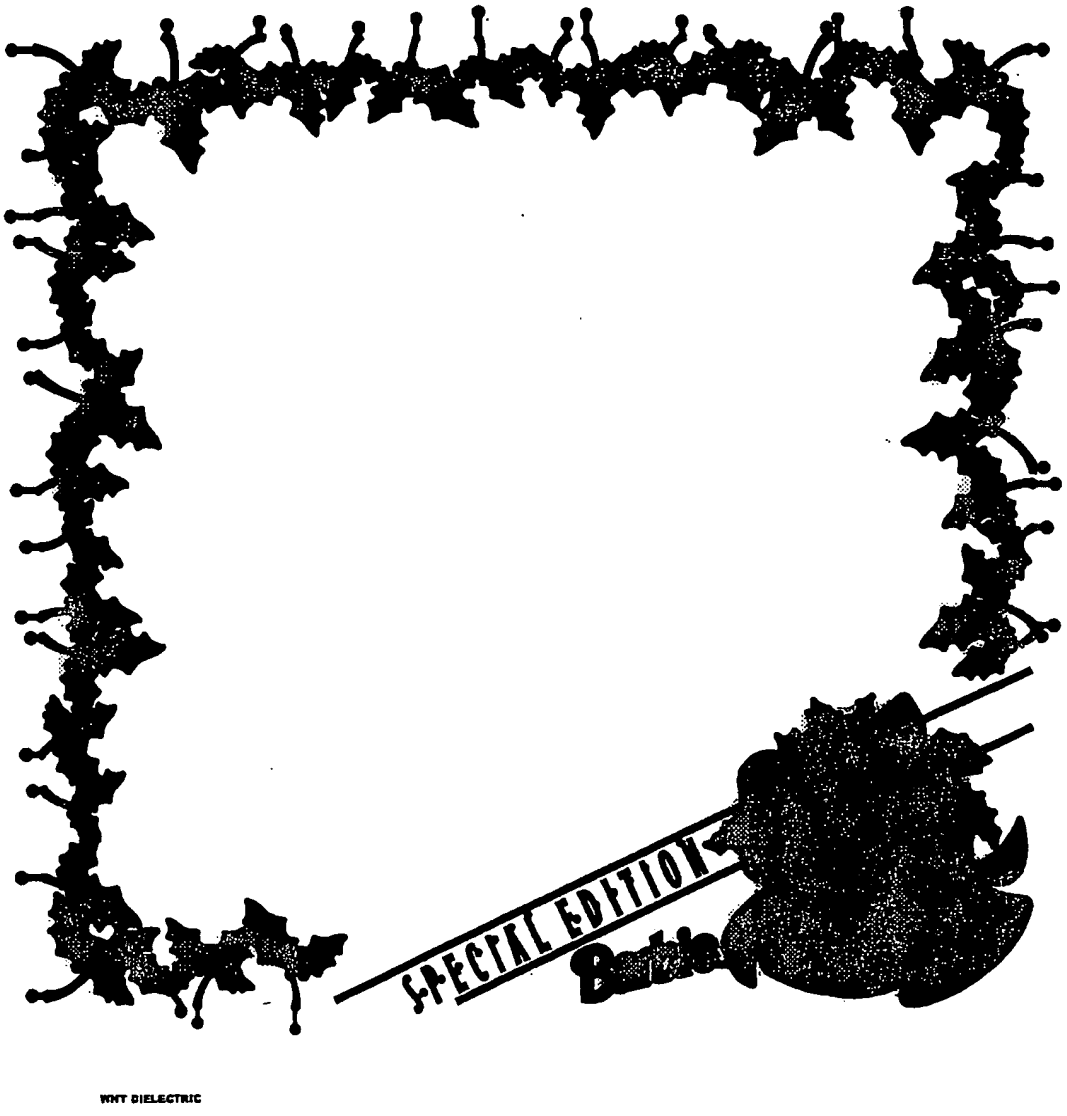
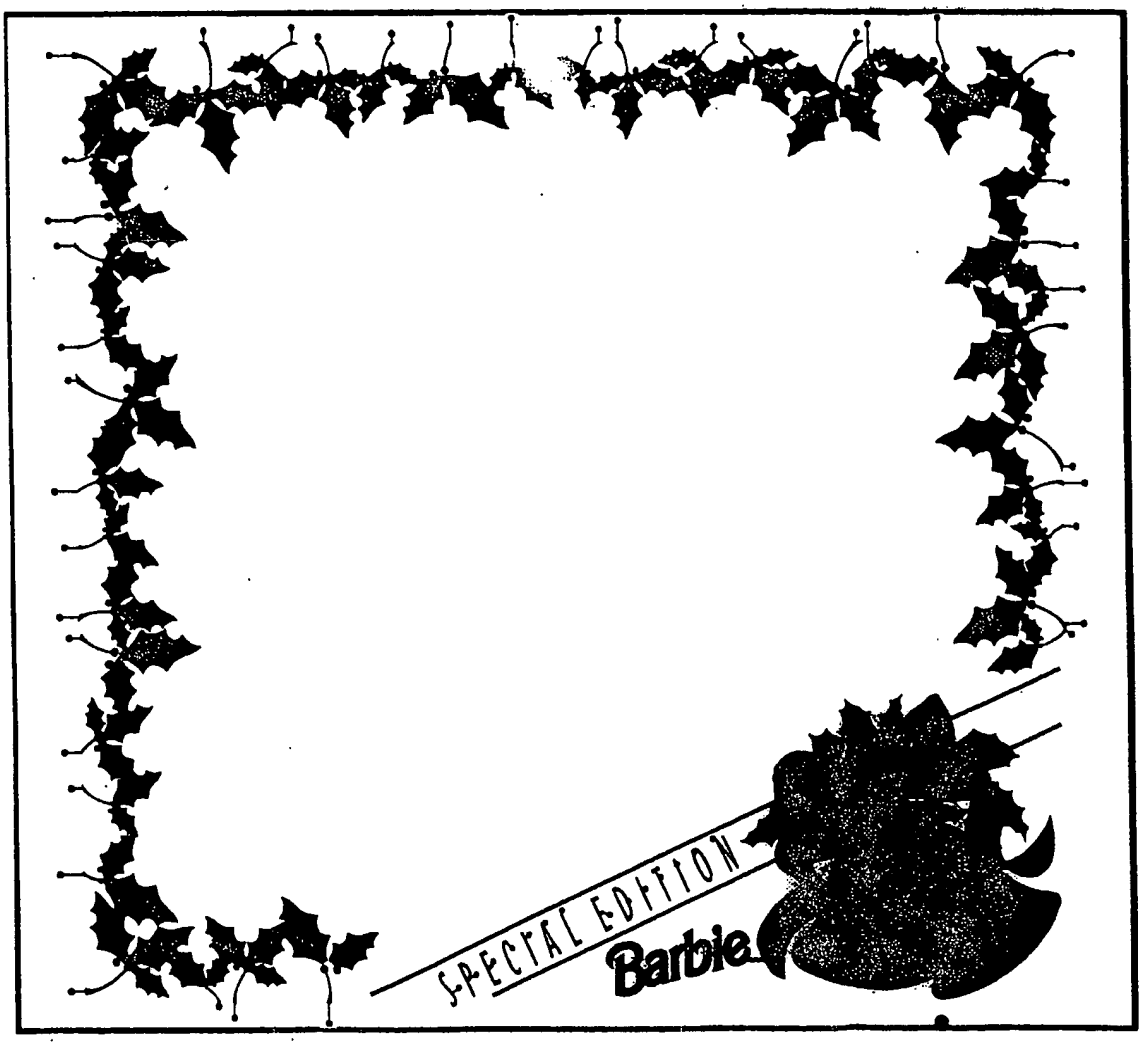


FIG. 9



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REAR ELECTRODE

FIG. 10

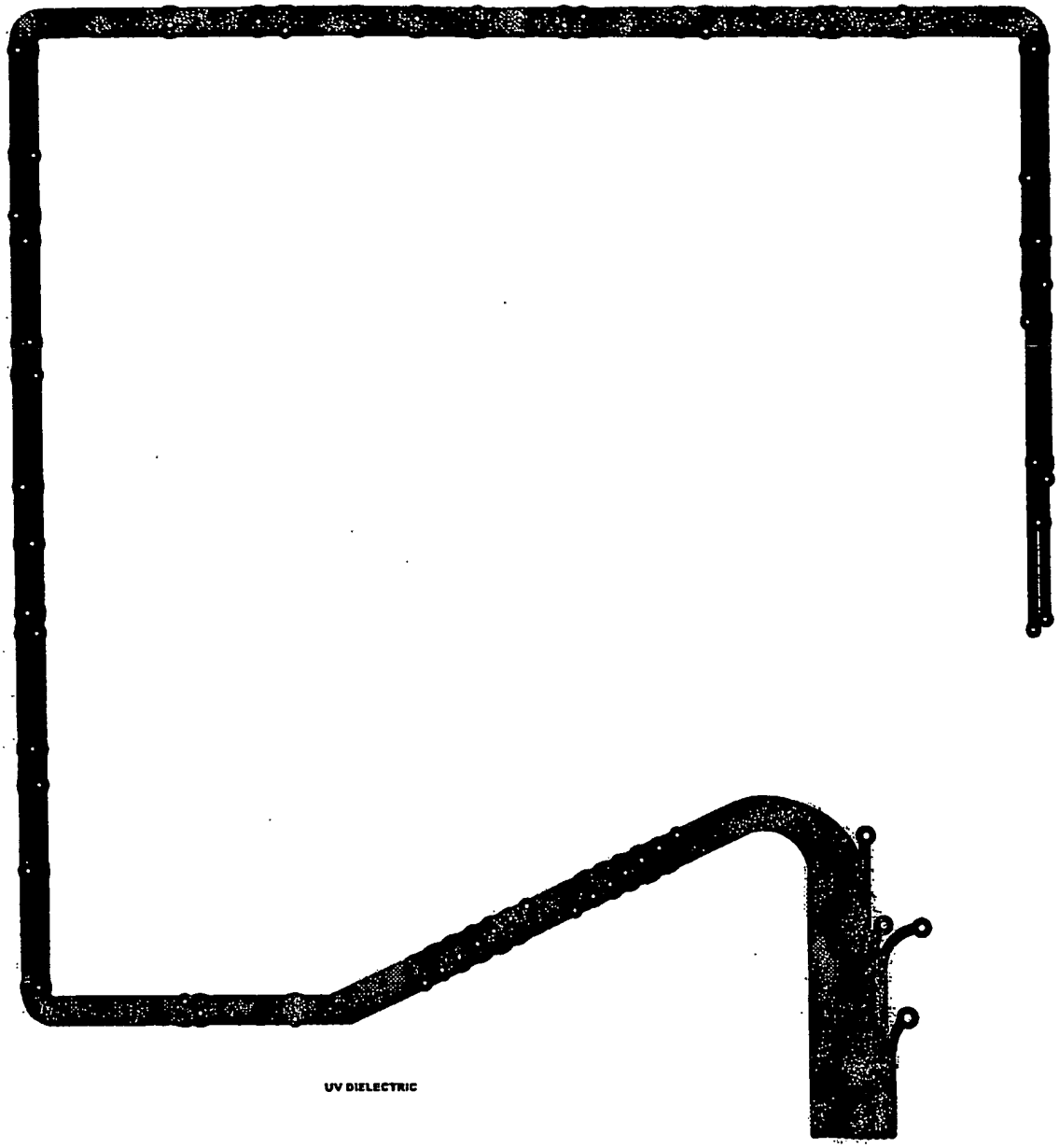

FIG. 11

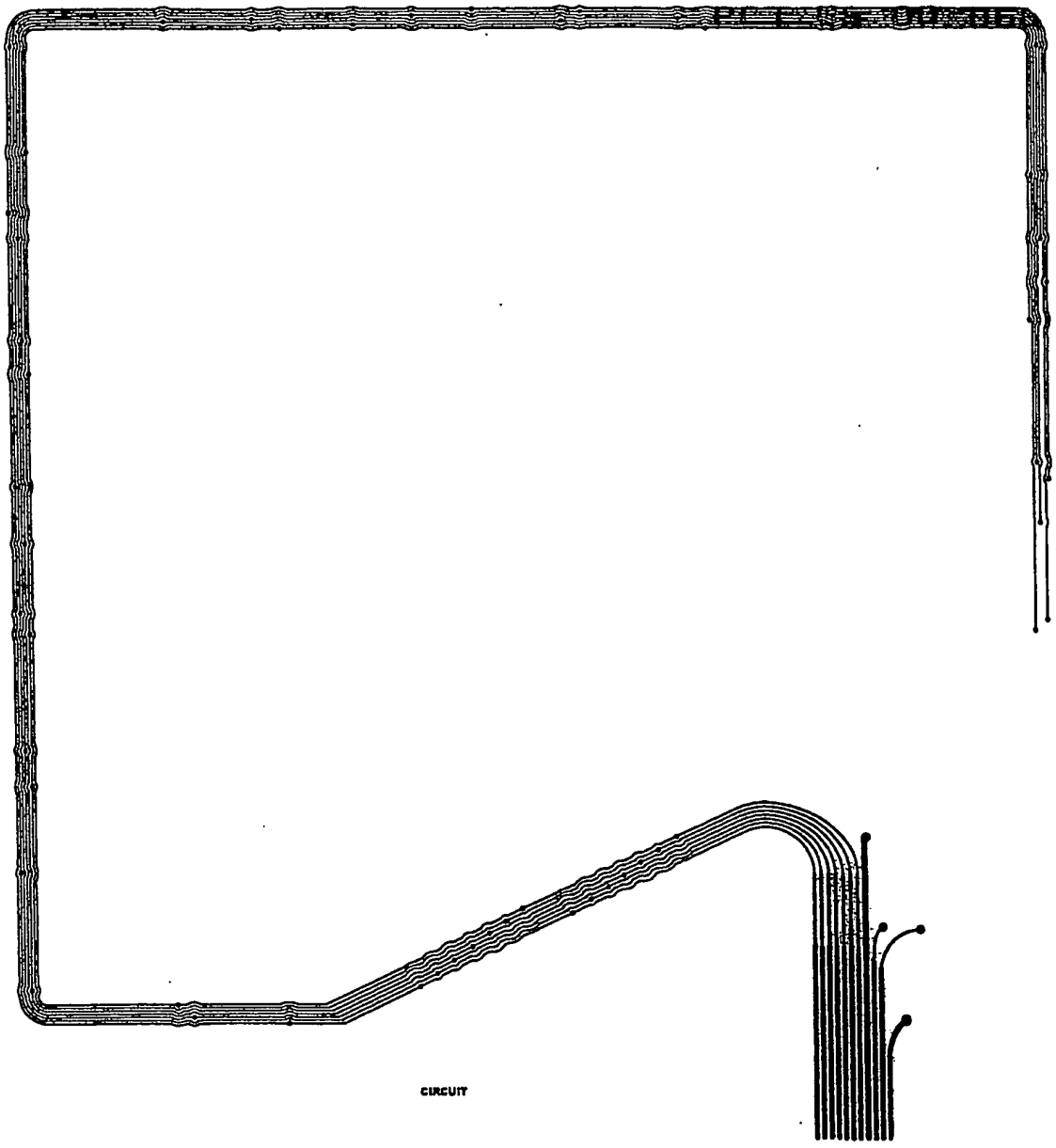

FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/06870

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G06F 13/00
US CL :345/173, 76; 313/505, 506

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 345/173, 76; 313/505, 506

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST, IEEE, CAS ONLINE, JPO, DERWENT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,680,160 A (LAPOINTE) 21 October 1997, see (col.2, lines 7-9, 38-47, col.3, lines 18-21; col.4, lines 10-30, 56-col.5, line 8)	1-4, 12, 18 ---------- 5-11, 13-17, 19
Y	US 5,359,341 A (HUTCHINGS), 25 October 1994, See Col.4, lines 5-21; col.2, lines 55-65; col.1, lines 8-16; Fig.1 and Fig.2.	5, 6, 9, 13
Y	US 4,740,781 A (BROWN) 26 April 1988, see (col.2, lines 13-36; col.3, lines 38-41; col.5, lines 44-46.	7, 8, 17, 19
Y	US 5,720,639 A (STEVENSON) 24 February 1998, see col.4, lines 19-32; col.2, lines 42-50.	10, 11, 14-16

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 03 JUNE 2000	Date of mailing of the international search report 11 JUL 2000
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